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(71) Applicant: SONY CORPORATION  
7-35 Kitashinagawa 6-Chome Shinagawa-ku  
Tokyo 141(JP)

(72) Inventor: Takeuchi, Hiroshi, C/o Patents  
Division  
Sony Corporation, 6-7-35 Kitashinagawa  
Shinagawa-ku Tokyo 141(JP)  
Inventor: Yukita, Yasuo, C/o Patents Division  
Sony Corporation, 6-7-35 Kitashinagawa  
Shinagawa-ku Tokyo 141(JP)  
Inventor: Hitachi, Akio, C/o Patents Division  
Sony Corporation, 6-7-35 Kitashinagawa  
Shinagawa-ku Tokyo 141(JP)

Inventor: Ukeyama, Kazuya, C/o Patents

Division  
Sony Corporation, 6-7-35 Kitashinagawa  
Shinagawa-ku Tokyo 141(JP)

Inventor: Sone, Masakazu, C/o Patents

Division  
Sony Corporation, 6-7-35 Kitashinagawa  
Shinagawa-ku Tokyo 141(JP)

Inventor: Funayama, Hidehiko, C/o Patents  
Division  
Sony Corporation, 6-7-35 Kitashinagawa  
Shinagawa-ku Tokyo 141(JP)

Inventor: Hirumi, Yasushi, C/o Patents  
Division  
Sony Corporation, 6-7-35 Kitashinagawa  
Shinagawa-ku Tokyo 141(JP)

(74) Representative: Purvis, William Michael  
Cameron et al  
D. Young & Co. 10 Staple Inn  
London WC1V 7RD(GB)

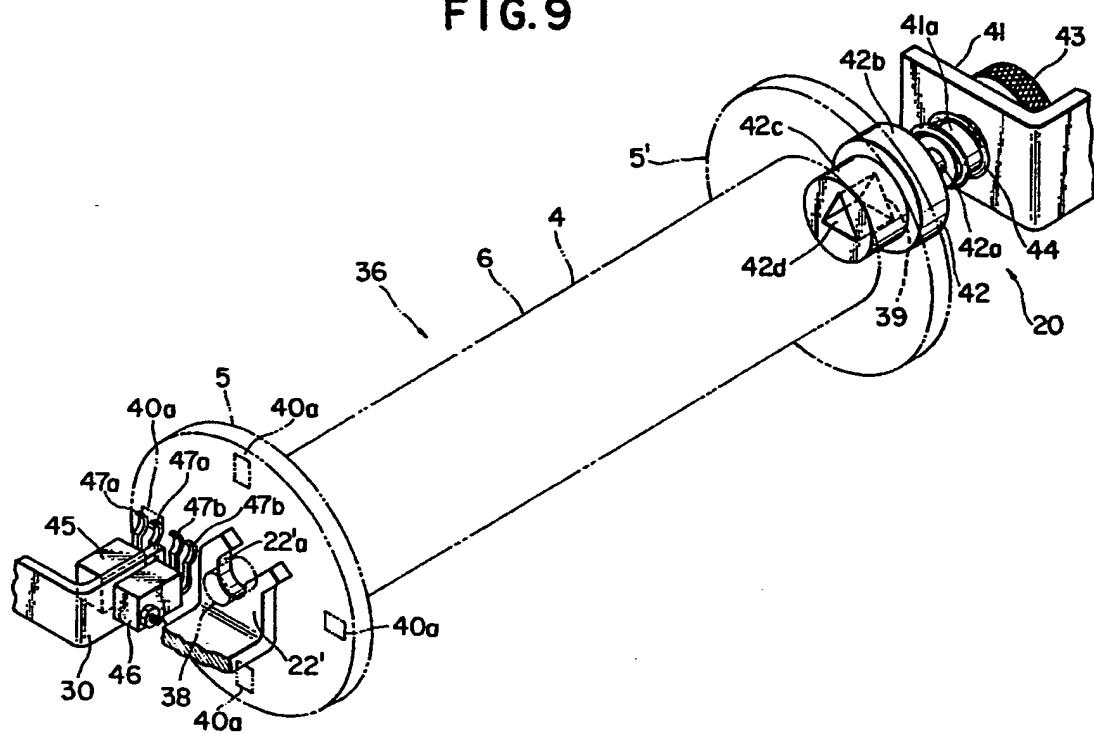
(54) Spool for thermal print roll paper.

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(57) A spool (36) for thermal print roll paper enables detection of a recording characteristic and/or the amount of roll paper remaining thereon by means of a detecting device (45, 46) provided on a printer body and prevents erroneous loading of roll paper. The spool (36) has a detecting portion (40a) and/or an engaging portion (38, 39) formed in an integral relationship at the ends thereof so that the end

portion thereof may have a function of identifying a recording characteristic or a remaining amount of print roll paper on the spool or of preventing erroneous loading of roll paper. The spool (36) can be made of a synthetic resin material so that the production cost thereof will not be increased significantly.

**FIG. 9**



## SPOOL FOR THERMAL PRINT ROLL PAPER

The invention relates to a spool for thermal print roll paper, that is to say a spool on which thermal roll paper for use with a thermal printer can be rolled.

Such thermal print roll paper is generally surface treated on at least one of the opposite faces thereof so as to accept printing images thereon and has one of a plurality of gradient recording characteristics.

Generally, print paper can be roughly classified into roll paper type and cutform type based on the form of use. Roll paper is normally provided in such a condition that it is wound on a spool formed as a substantially cylindrical tube made of thick paper. Such roll paper is loaded in a printer such that the spool thereof is supported for rotation at a predetermined roll paper loading station provided in the printer.

Print paper for use with a printer is processed in most cases by a predetermined method so that only one of the opposite faces thereof will accept printing or good printing image, and particularly roll paper for a thermal printer has applied to only one of the opposite faces thereof a recording material which develops an image when it is heated. Accordingly, roll paper for a thermal printer must necessarily be loaded in a printer in such a predetermined orientation that the processed face thereof, that is, a printing surface thereof, will be opposed to a thermal head in a paper feeding path.

Some recent thermal printers can be printed with a gradient (variable density/half tone) reproducibility. For a thermal printer having such a function, both conventional thermosensible paper which is used to print for the two value (white/black) recording and thermosensible paper that is used for gradient recording printing as described above are prepared, and use of various types of roll paper having various image developing characteristics is increasing for printers having the same recording system.

As the number of types of roll paper increases as described above, identification of them relying on human judgement will result in an increase of the possibility that roll paper may be loaded in error. That is, roll paper of a different type to those specified for a printer may be loaded or roll paper which is not suitable for a set mode of a printer may be loaded, resulting in a printout in which a printed image is low in gradient reproducibility. Further, since a coupling portion of a conventional spool for roll paper to a spool loading station of a printer body is common in structure at the opposite ends of the spool, the orientation of the spool loaded in the spool loading station is not restricted

decisively, and accordingly, there is a problem that a face of the roll paper which is not a printing surface may possibly be opposed to a thermal head of the printer.

- 5 According to the invention there is provided a spool for thermal print roll paper, comprising:  
a main hub portion on which printing paper can be rolled;  
a pair of edge portions integrally formed with the main hub portion by moulding synthetic resin; and  
a first engaging portion and a second engaging portion formed on respective ones of the edge portions and to be engaged with a pair of engaging members provided in a printing machine, wherein  
10 the shapes of the first engaging portion and the second engaging portion are different from each other so as to prevent erroneous installation of the spool of thermal print roll paper into a printing machine.
- 15 The spool may further comprise a mark provided on one of the edge portions of the spool to be coupled to a detector provided in a printing machine to detect characteristics of the thermal print roll paper of the spool.
- 20 Alternatively, the spool may further comprise a first mark provided on one of the edge portions of the spool to be coupled to a detector provided in a printing machine to detect a remaining amount of thermal print roll paper on the spool. The spool may additionally comprises a second mark provided on one of the edge portions of the spool to be coupled to a detector provided in a printing machine to detect characteristics of the thermal print roll paper on the spool. The first mark and the second mark may be provided on the same surface of one of the edge portions.
- 25 Thus the edge portions of the spool can have a function of detecting a remaining amount of thermal print roll paper on the spool in addition to functions of identification of a recording characteristic of roll paper or prevention of erroneous loading of roll paper. Accordingly, an erroneous printout which might be caused by a gradient recording characteristic of roll paper loaded not being compatible with a set mode of a printer, or another erroneous printout which might be caused by printing on a face of roll paper which is not a printing surface or by an erroneous forecast of a remaining amount of roll paper, can be prevented. Since the engaging portions and/or the marks can be formed in an integral relationship with the main hub portion of the spool from a synthetic resin material, the number of parts need not be increased nor need the cost be increased significantly.
- 30 The invention is diagrammatically illustrated by
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way of example in the accompanying drawings, in which:-

Figures 1(A) and 1(B) are perspective views of two paper rolls, comprising different types of print roll paper for use with a thermal printer with different gradient recording characteristics, wound on different spools according to the invention;

Figure 2 is a vertical sectional view of a thermal printer in which the paper rolls shown in Figures 1(A) and 1(B) are used;

Figure 3 is an enlarged perspective view showing part of the printer shown in Figure 2;

Figures 4(A) and 4(B) are partial plan views of part of a roll paper loading station at which the paper rolls shown in Figures 1(A) and 1(B) are loaded, respectively;

Figures 5(A) and 5(B) are perspective views showing modifications to the spools shown in Figures 1(A) and 1(B), respectively;

Figures 6(A) and 6(B) are enlarged partial plan views, partly in section, showing a roll paper loading station at which the modified spools shown in Figures 5(A) and 5(B) are loaded, respectively;

Figures 7(A) and 7(B) are perspective views of two spools for print roll paper according to a second embodiment of the invention;

Figure 8 is a plan view, partly in section, showing a roll paper loading station for the spools shown in Figures 7(A) and 7(B);

Figure 9 is a perspective view showing part of the roll paper loading station shown in Figure 8;

Figures 10(A) and 10(B) are side elevational views showing part of the roll paper loading station at which the spools shown in Figures 7(A) and 7(B) are loaded, respectively;

Figures 11(A) and 11(B) are perspective views showing modifications to the spools shown in Figures 7(A) and 7(B), respectively;

Figures 12(A) and 12(B) are partial plan views, partly in section, showing the modified spools of Figures 11(A) and 11(B) in a loaded condition;

Figures 13(A) and 13(B) are perspective views of two spools for print roll paper according to a third embodiment of the present invention;

Figure 14 is a plan view, partly in section, showing a roll paper loading station for the spools shown in Figures 13(A) and 13(B);

Figure 15 is a perspective view showing part of the roll paper loading station shown in Figure 14; and

Figures 16(A) and 16(B) are partial plan views, partly in section, showing the roll paper loading station of Figure 14 at which the spools shown in Figures 13(A) and 13(B) are loaded, respectively.

Referring to the drawings and firstly to Figures 1(A) and 1(B), there are shown paper rolls wherein

thermal print roll paper of two types is respectively mounted on different spools according to a first embodiment of the invention.

In particular, the paper rolls shown in Figures 1(A) and 1(B) are denoted at 1A and 1B, respectively, and include each a spool 2 or 3 formed in a unitary block from several components made of a synthetic resin material. In particular, each of the spools 2 and 3 includes a spool main portion 6 which includes a core shaft 4 having a substantially cylindrical configuration and a pair of flanges 5 and 5' extending radially in planes perpendicular to the core shaft 4 from the opposite ends of the core shaft 4. The flange 5 has four small projections 7a or 7b formed on and extending axially from an outer end face of the flange 5. The spool main portion 6 and the projections 7a or 7b are formed in an integral relationship from a synthetic resin material. The core shaft 4 has an insertion hole 8 formed at the centre thereof and extending along the axis therethrough. The insertion hole 8 has a circular cross section and has such a tapered configuration that the diameter of the circular cross section thereof gradually increases from an end 8a thereof adjacent the flange 5 toward the other end 8b thereof adjacent the other flange 5'. The projections 7a on the spool 2 of the paper roll 1A are disposed in an angularly spaced relationship by about 90 degrees from each other with respect to the axis of the spool 2 adjacent an outer peripheral edge of the flange 5 while the projections 7b on the spool 3 of the other paper roll 1B are disposed in an angularly spaced relationship by about 90 degrees from each other with respect to the axis of the spool 3 at substantially radially intermediate locations of the flange 5 between the outer peripheral edge of the flange 5 and the insertion hole 8.

Thermal print roll paper 9 and 10 has a recording material of the thermally image developing type applied to a face 9a or 10a thereof. The thermal roll paper 9 and the other thermal roll paper 10 have different gradient recording characteristics from each other.

The thermal roll paper 9 is wound on the core shaft 4 of the spool 2 while the thermal roll paper 10 is wound on the core shaft 4 of the spool 3 such that the face 9a or 10a, that is, the printing surface of each of them may be directed away from the core shaft 4 side and it may be wound in the clockwise direction as viewed from the flange 5 side on which the projections 7a or 7b are provided.

Thus, the paper roll 1A is constituted from the spool 2 and the thermal roll paper 9 wound on the spool 2 while the other paper roll 1B is constituted from the spool 3 and the thermal roll paper 10 wound on the spool 3, and the two paper rolls 1A and 1B are different in structure from each other in

that the projections 7a and 7b are spaced by different distances from the centre axes of the spools 2 and 3 from each other.

Referring now to Figures 2 to 4(B), the paper rolls 1A and 1B are selectively used on a thermal printer 11.

The thermal printer 11 includes an outer housing 12, a platen 13 provided for rotation in the outer housing 12, and a thermal head 14 disposed behind and in an opposing relationship to the platen 13. The thermal head 14 includes a circuit board member 15 on which a head driving circuit (not shown) is provided and a head support member 16 secured to a front end face of the circuit board member 15. A plurality of heat generating resistor members (not shown) are disposed on a portion of an outer periphery of the head support member 16 which is opposed to the platen 13 such that amounts of heat to be generated by the heat generating members may be individually controlled for each set printing mode in accordance with a pattern of picture elements for a print line of print data supplied to the thermal printer 11.

It is to be noted that the thermal head 14 having such a construction as described just above is moved, only when a printing operation is to be performed, to an advanced position at which the heat generating face thereof contacts the platen 13 as indicated in solid lines in Figure 2, but in any other case, it is held at a standby position at which it is spaced by a small distance rearwardly away from the platen 13 as indicated in broken lines in Figure 2.

A paper guide 17 is disposed on the inside of a paper outlet opening 12a of the outer housing 12 in an opposing relationship to and in the neighbourhood of the paper outlet opening 12a. A pair of paper feed rollers 18 are disposed between the platen 13 and the paper guide 17 while a cutter mechanism 19 is disposed between the paper guide 17 and the paper outlet opening 12a of the outer housing 12.

A roll paper loading station 20 removably to receive the paper roll 1A or 1B thereon is disposed in the outer housing 12. The roll paper loading station 20 includes a pair of support members 21 and 22 provided spaced apart from each other by a distance equal to the axial length of the paper rolls 1A and 1B. The support members 21 and 22 have cylindrical fitting projections 23 and 24 formed on opposing faces 21a and 22a thereof. The fitting projection 23 has a diameter a little smaller than the inner diameter of the end 8a of the insertion hole 8 of the spool 2 or 3 while the other fitting projection 24 has a diameter a little smaller than the inner diameter of the other end 8b of the insertion hole 8.

The support member 22 is secured to a frame

member (not shown) of the thermal printer 11 while the support member 21 is supported for sliding movement on the frame member so as to allow adjustment of the distance thereof from the support member 22 and the support member 21 is normally urged toward the support member 22 by a resilient member (not shown).

The paper roll 1A or 1B is loaded at the roll paper loading station 20 in the following manner.

Firstly, the fitting projection 24 of the support member 22 is inserted into the end 8b of the insertion hole 8 of the spool 2 or 3. In this instance, since the insertion hole 8 is different in diameter at the opposite ends 8a and 8b thereof, it is impossible to fit the fitting projection 24 into the other end 8a of the fitting hole 8 if the paper roll 1A or 1B is in the reverse orientation.

Then, while the support member 21 is held moved away from the support member 22, the fitting projection 23 thereon is inserted into the corresponding end 8a of the insertion hole 8.

Consequently, the end faces of the flanges 5 and 5' are engaged with the opposing faces 21a and 22a of the support members 21 and 22, and the spool 2 or 3 is supported for rotation on and between the support members 21 and 22 while it is urged toward the support member 22 by the support member 21 under the urging force of the resilient member mentioned hereinabove.

Setting of the thermal roll paper 9 or 10 loaded at the roll paper loading station 20 to a position on a feeding path thereof is performed in that a lead portion of the thermal roll paper 9 or 10 is partially wrapped in the clockwise direction around an outer periphery of the platen 13 and then threaded between the paper feed rollers 18 as can be seen in Figure 2.

In this instance, the thermal roll paper 9 or 10 is threaded along the feed path such that the print face 9a or 10a thereof is opposed to the thermal head 14.

A detecting device 25 is provided to identify a gradient recording characteristic and to detect a remaining amount of the thermal roll paper 9 or 10 of the paper roll 1A or 1B loaded at the roll paper loading station 20.

The detecting device 25 includes a pair of contact fingers 26 and 27 each formed from a resilient member such as, for example, a leaf spring. The contact fingers 26 and 27 are disposed in an opposing relationship to the projections 7a and 7b, respectively, provided on the flanges 5 of the paper roll 1A or 1B when the roll paper 1A or 1B is loaded at the roll paper loading station 20.

In particular, the contact finger 26 is positioned to be engaged successively by the projections 7a when one of the spools 2 loaded at the roll paper loading station 20 is rotated around its axis. Each

time the contact finger 26 is engaged by a projection 7a, the contact of a switch 28 is closed.

The contact finger 27 is positioned to be engaged successively by the projections 7b when one of the spools 3 loaded at the roll paper loading station 20 is rotated around its axis. Each time the contact finger 27 is engaged by a projection 7b, the contact of a switch 29 is closed.

The contact fingers 26 and 27 have bent portions 26a and 27a formed at portions adjacent the free ends thereof, respectively, while they are mounted at the other end portions thereof on a switch mounting plate 30. The switches 28 and 29 are also mounted on the switch mounting plate 30.

Thus, an indication of the recording characteristic of thermal print roll paper on the spool 2 or 3 loaded at the paper roll loading station 20 can be obtained by noting which one of the switches 28 and 29 generates a pulse signal.

Since the roll paper 9 or 10 is fed at a constant speed by the paper feed rollers 18, the speed of rotation of the paper roll 1A or 1B rises as the diameter of the paper roll 1A or 1B decreases, that is, as the remaining amount of the roll paper 9 or 10 decreases, and in accordance with such rise of the speed of rotation, the number of pulses per fixed period of time gradually increases. From such variation in number of pulses, the amount remaining of the thermal roll paper 9 or 10 can be detected and consequently can be displayed. Alternatively, since rotation of the spool 2 or 3 stops when the remaining amount of the thermal roll paper 9 or 10 is reduced to zero, the number of pulses of the pulse signal per fixed period of time is reduced to zero. Accordingly, when such condition is detected, it can be indicated or notified, for example by warning sounds, that the paper has been used up.

Figures 5 and 6 show modifications to the spools of the first embodiment of the invention described above.

The modified spools are substantially similar to those of the spools 2 and 3 described above and only different therefrom in the structure of detecting portions thereof which are provided for the detection of a gradient recording characteristic and a remaining amount of roll paper. Thus, description will be given below only of such differences, and those elements which have like structure or like functions to those shown in Figures 1A to 4B are denoted by like reference numerals. This also applies to the second and third embodiments described hereinbelow.

In each of the modified spools denoted at 31 and 32, the flange 5 has a groove 33a or 33b formed on an outer end face thereof and extending in a circumferential direction around an axis of the spool 31 or 32. The groove 33a of the spool 31 is

located substantially at a mid position between an outer circumferential edge of the flange 5 and the insertion hole 8 of the spool 31 while the groove 33b of the other spool 32 is located adjacent the insertion hole 8.

The detecting device 25 includes the pair of contact fingers 26 and 27 having bent portions 26a and 27a formed adjacent the free ends thereof in an opposing relationship to the grooves 33a and 33b of the spools 31 and 32, respectively. In particular, when the spool 31 is loaded at a paper roll loading station 20, the bent portion 26a of the contact finger 26 is engaged with the groove 33a of the flange 5 of the spool 31, and accordingly, the contact of the switch 28 provided corresponding to the contact finger 26 remains in an open state. The contact finger 27 is engaged at the bent portion 27a thereof with the outer end face of the flange 5 and deflected by the latter toward the switch 29 to close the contact of the switch 29. On the other hand, when the spool 32 is loaded at the roll paper loading station 20, the bent portion 27a of the contact finger 27 is engaged with the groove 33b of the flange of the spool 32, and consequently, the contact of the switch 29 remains in an open state. Meanwhile, the bent portion 26a of the contact finger 26 is engaged and deflected by the outer end face of the flange 5 toward the switch 28 to close the contact of the switch 28.

A pattern 34 for the generation of a frequency signal is provided on the flange 5 of each of the spools 31 and 32. The pattern 34 includes a large number of detecting elements 34a disposed in a predetermined circumferentially spaced relationship on the end face adjacent the outer periphery of the flange 5. The detecting elements 34a have a reflection factor different from that of the end face of the flange 5. The detecting elements 34a may be formed in an integral relationship with the spool main portion 6 of the spool 31 or 32, for example, by so-called double colour moulding.

A photo-sensor 35 is mounted on a circuit board (not shown) secured to the outer housing 12 and includes a light emitting element 35a and a light receiving element 35b. The photo-sensor 35 is disposed in an opposing relationship to the outer circumferential portion of the end face of the flange 5 of the spool 31 or 32 loaded at the roll paper loading station 20.

Thus, it is possible to determine when a spool loaded on the roll paper loading station 20 rotates, which one of the switches 28 and 29 generates a pulse signal and thereby identify the recording characteristic of the roll paper wound on the spool.

Also, since the frequency signal generating pattern 34 rotates upon rotation of the spool 31 or 32, the light receiving element 35b develops an output signal in the form of pulses, and since the

speed of rotation of the spool increases as the remaining amount of the thermal roll paper wound on the spool decreases, the amount remaining of the thermal roll paper can be detected by measuring the frequency of the output pulse signal of the light receiving element 35b.

Referring now to Figures 7(A) to 10(B), spools for print roll paper according to a second embodiment of the invention are shown. The spools are denoted by reference numerals 36 and 37 and include each a pair of flanges 5 and 5'. A support projection 38 having a circular cross section is provided at the centre of the outer face of the flange 5 of each of the spools 36 and 37 while another support projection 39 having a cross section of a substantially equilateral triangle is provided at the centre of the outer face of the other flange 5'. Further, four metal pieces 40a or 40b made of a material having a high electric conductivity are provided on the flange 5 of each of the spools 36 and 37. The metal pieces 40a or 40b are each embedded in the flange 5 such that one face thereof is positioned flush with the outer face of the flange 5 and the pieces are disposed in a circumferentially spaced relationship by an angle substantially equal to 90 degrees around the axis of the flange 5. The metal pieces 40a of the spool 36 are provided on the outer end face adjacent an outer periphery of the flange 5 while the metal pieces 40b of the other spool 37 are provided substantially at mid locations of the outer end face of the spool 5 between the outer periphery of the flange 5 and the support projection 38 on the flange 5.

It is to be noted that the support projections 38 and 39 are formed from a synthetic resin material in an integral relationship with a spool main portion 6 which includes the flanges 5, 5' and a core shaft 4 in and the metal pieces 40a and 40b are formed in an integral relationship with the spool main portion 6 by insert moulding with the flanges 5.

Referring to Figures 8 and 9, a support member 22' is secured to an outer housing (not shown) and has a substantially C-shaped recess 22'a formed therein such that an end portion thereof is opened obliquely upwardly so that the support projection 38 provided on the flange 5 of the spool 36 or 37 may be received into the recess 22'a.

A support wall 41 is disposed on the opposite side of the roll paper loading station 20 to the support member 22'. The support wall 41 has a cylindrical support projection or hub portion 41a formed at a portion of an inner face thereof opposing a lower portion of the recess 22'a of the support member 22', and a spool supporting shaft 42 is supported for axial movement within a predetermined fixed range in the cylindrical support projection 41a of the support wall 41. The spool support-

ing shaft 42 is formed as a unitary member having a shaft portion 42a in the form of a circular section rod, a spring receiving flange 42b connected to an axial end of the shaft portion 42a adjacent the support member 22', and a support portion 42c extending from the spring receiving flange 42b towards the support member 22'. A fitting hole 42d is formed in the support portion 42c of the spool supporting shaft 42 such that it is open to the support member 22' side. The fitting hole 42d is so shaped and dimensioned that the support projection 39 provided on the spool 36 or 37 may fit substantially neatly therein, and accordingly, the fitting hole 42d has a triangular cross section. The spool supporting shaft in 2 of such construction is inserted at the shaft portion 42a thereof for sliding movement in the cylindrical support projection 41a of the support wall 41 and has a knob 43 secured to an end of the shaft portion 42a thereof remote from the support portion 42c. A coil spring 44 is interposed in a compressed condition between the support wall 41 and the spring receiving flange 42b of the spool supporting shaft 42.

In loading the spool 36 or 37 onto the roll paper loading station 20, the cylindrical support projection 38 thereon is inserted into the recess 22'a of the support member 22', and then the other triangular support projection 39 is inserted into the fitting hole 42d of the spool supporting shaft 42.

It is to be noted that, even if it is attempted to insert the support projection 38 into the fitting hole 42d of the spool supporting shaft 42, such attempt will result in failure because they have different cross sections from each other. Accordingly, the spool 36 or 37 will always be loaded in a correct orientation.

A pair of detecting devices 45 and 46 are provided, and each of the detecting devices 45 and 46 has a pair of leaf-shaped contact fingers 47a or 47b. The contact fingers 47a of the detecting device 45 are disposed such that they may be successively engaged resiliently and lightly with the metal pieces 40a of the spool 36 loaded at the roll paper loading station 20 when the spool 36 rotates while the contact fingers 47b of the detecting device 46 are disposed such that they may be successively contacted resiliently and lightly with the metal pieces 40b of the spool 37 loaded at the roll paper loading station 20 when the spool 37 rotates.

Accordingly, when the spool 36 is loaded and rotated, the contact fingers 47 of the detecting device 45 are intermittently short-circuited by the metal pieces 40a of the spool 36, and consequently, the detecting device 45 develops a predetermined pulse signal. On the other hand, when the other spool 37 is loaded and rotated, then the contact fingers 47b of the detecting device 47 are intermittently short-circuited by the metal pieces

40b of the spool 37, and consequently, another predetermined pulse signal is developed from the detection device 46. Accordingly, a recording characteristic of thermal roll paper can be identified depending upon from which one of the detection devices 45 and 46 a pulse signal is developed. Further, the remaining amount of thermal print roll paper can be detected by measuring a frequency of the pulse signal.

Referring now to Figures 11(A) to 12(B), there are shown modifications to the spools 36 and 37 shown in Figures 7(A) to 10(B). The modified spools denoted at 48 and 49 are different from the spools 36 and 37 in that detection of a gradient recording characteristic and detection of the remaining amount of thermal roll paper are effected using magnetic means.

In each of the modified spools 48 and 49, a flange 5 has four magnetized portions 50a or 50b which are spaced by an angular distance equal to about 90 degrees in a circumferential direction around the centre of the flange 5. The magnetized portions 50a on the spool 48 are provided on an outer end face adjacent an outer periphery of the flange 5 while the magnetized portions 50b on the other spool 49 are provided at substantially mid locations on the outer end face of the spool 5 between the outer periphery of the spool 5 and the support projection 38.

A detecting coil 51 is disposed in the proximity of and in an opposing relationship to a locus of rotation of the magnetized portions 50a of the spool 48 loaded at the roll paper loading station 20 and a detecting coil 52 is disposed in the proximity of and in an opposing relationship to a locus of rotation of the magnetized portions 50b of the spool 49 loaded at the roll paper loading station 20.

When the spool 48 is loaded and rotated, the magnetized portions 50a thereof are intermittently opposed to the detecting coil 51, and consequently, a voltage is induced in the detecting coil 51. On the other hand, when the spool 49 is loaded and rotated, the magnetized portions 50b thereon are intermittently opposed to the other detecting coil 52 so that a voltage is induced in the detecting coil 52. Accordingly, a recording characteristic of thermal roll paper can be identified depending upon from which one of the detecting coils 51 and 52 a signal is detected. Further, the remaining amount of the thermal roll paper can be detected by detecting a frequency of the pulse voltage or current of the signal developed from the detecting coil 51 or 52.

Referring now to Figures 13(A) to 16(B), there are shown spools 53, 54 for print roll paper according to a third embodiment of the present invention.

In each of the spools 53 and 54, the flange 5 at one end has a support hole 55 of circular cross

section formed at the centre thereof while the flange 5 at the other end has a support hole 56 of a cross section of a substantially equilateral triangle formed at the centre thereof.

The flange 5 of each of the spools 53 and 54 is treated at an outer end face thereof such that it may have a comparatively high reflection factor. The flange 5 has four transparent portions 57a or 57b disposed in a circumferentially spaced relationship by an angular distance of about 90 degrees around the centre thereof. The transparent portions 57a and 57b may be made of a transparent synthetic resin material. The transparent portions 57a of the spool 53 are provided adjacent an outer periphery of the flange 5 while the transparent portions 57b of the other spool 54 are provided at substantially mid locations between the outer periphery of the flange 5 and the support hole 55.

It is to be noted that the spool main portion 6 and the transparent portions 57a or 57b may be formed in an integral relationship by double colour moulding of a synthetic resin material.

Referring particularly to Figures 14 and 15, a pair of support walls 58 and 59 are disposed in opposing relationship to each other. A fitting projection 58a in the form of a round post extends inwardly from an inner face of the support wall 58. The fitting projection 58a has substantially the same diameter as the inner diameter of the support hole 55. A cylindrical support tube 59a is formed on and extends inwardly from an inner face of the support wall 59 in an opposing relationship to the fitting projection 58a of the support wall 58.

A spool supporting shaft 60 having substantially the same structure as that of the spool supporting shaft 42 described hereinabove is mounted on the support wall 59. The spool supporting shaft 60 has a shaft portion 60a which is supported for sliding movement in the support tube 59a of the support wall 59. The spool shaft 60 further has a spring receiving flange 60b and a fitting projection 60c extending from the spring receiving flange 60b toward the support wall 58. The fitting projection 60c of the spool shaft 60 has a triangular cross section which is a complementary cross section to that of the support hole 56 of the spool 53 or 54.

In loading the spool 53 or 54 at the roll paper loading station 20, the fitting projection 58a provided on the support wall 58 is inserted into the support hole 55 of the spool 53 or 54, and then the fitting projection 60c of the spool supporting shaft 60 on the other support wall 59 is inserted into the other support hole 56 of the spool 53 or 54.

It is to be noted that, even if it is attempted to insert the right-hand side fitting projection 60c into the support hole 55 of the spool 53 or 54 or to insert the left-hand side fitting projection 58a into the support hole 56 of the spool 53 or 54, since the

support holes 55 and 56 do not have cross sections of complementary shapes with those of the fitting projections 60c and 58a, respectively, such attempt will result in failure, and accordingly, the spool 53 or 54 will always be loaded in a correct orientation.

A pair of photo-sensors 61 and 62 are provided and include each a light emitting element 61a or 62a and a light receiving element 61b or 62b. The photo-sensor 61 is disposed in the proximity of and in an opposing relationship to a locus of rotation of the transparent portions 57a of the spool 53 loaded at the roll paper loading station 20 while the other photo-sensor 62 is disposed in the proximity of and in an opposing relationship to a locus of rotation of the transparent portions 57b of the other spool 54 loaded at the roll paper loading station 20.

When the spool 53 is loaded and rotated, the intensity of light received by the light receiving element 61b decreases each time a transparent portion 57a of the spool 53 is opposed to the optical sensor 61. Consequently, a predetermined pulse signal is produced from the photo-sensor 61. Meanwhile, a signal of a substantially fixed level is produced from the other photo-sensor 62.

On the other hand, when the spool 54 is loaded and rotated, the intensity of light received by the light receiving element 62b decreases each time a transparent portion 57b of the spool 54 is opposed to the photosensor 61. Consequently, a predetermined pulse signal is produced from the photo-sensor 62 while a signal of a substantially fixed level is produced from the photosensor 61. Accordingly, a recording characteristic of thermal roll paper can be identified depending upon from which one of the photo-sensors 61 and 62 a pulse signal is developed.

Further, the remaining amount of the thermal roll paper can be detected by detecting the frequency of such pulse signal.

It is to be noted that the transparent portions 57a and 57b could be replaced by recesses or holes which could be optically detected by the photo-sensors 61 and 62 or like optical elements.

It is also to be noted that, while detecting means for the detection of a recording characteristic serves also as detecting means for the detection of a remaining amount of roll paper in most of the embodiments and modifications described hereinabove, such construction can be effective to prevent the structure of a spool from being complicated.

Further, while in the embodiments and modifications described hereinabove identification of a recording characteristic of roll paper is performed based on a difference in distance between detecting elements and an axis of a spool, means for the identification of a gradient recording characteristic

according to a spool for thermal print roll paper is not limited to such specific means, and for example, the number of detecting elements may be differentiated for each roll paper having a different recording characteristic.

## Claims

1. A spool (2, 3, 31, 32, 36, 37, 48, 49, 53, 54) for thermal print roll paper (9, 10), comprising:  
a main hub portion (4) on which printing paper can be rolled;  
a pair of edge portions (5) integrally formed with the main hub portion (4) by moulding synthetic resin; and  
a first engaging portion (8a, 38, 55) and a second engaging portion (8b, 39, 56) formed on respective ones of the edge portions (5) and to be engaged with a pair of engaging members provided in a printing machine, wherein the shapes of the first engaging portion (8a, 38, 55) and the second engaging portion (8b, 39, 56) are different from each other so as to prevent erroneous installation of the spool of thermal print roll paper into a printing machine.
2. A spool for thermal print roll paper according to claim 1, including a first kind of mark (7a, 33a, 34, 40a, 50a, 57a) provided on one of the edge portions (5) of the spool to be coupled to a detector (26, 35, 47a, 51, 61) provided in a printing machine to detect the amount of thermal print roll paper remaining on the spool.
3. A spool for thermal print roll paper according to claim 1 or claim 2, including a second kind of mark (7b, 33b, 40b, 50b, 57b) provided on one of the edge portions of the spool to be coupled to a detector (27, 33b, 47b, 52, 62) provided in a printing machine to detect characteristics of the thermal print roll paper of the spool.
4. A spool for thermal print roll paper according to claim 3, wherein the first kind of mark and the second kind of mark are provided on the same surface of one of the edge portions (5).

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FIG. I (A)

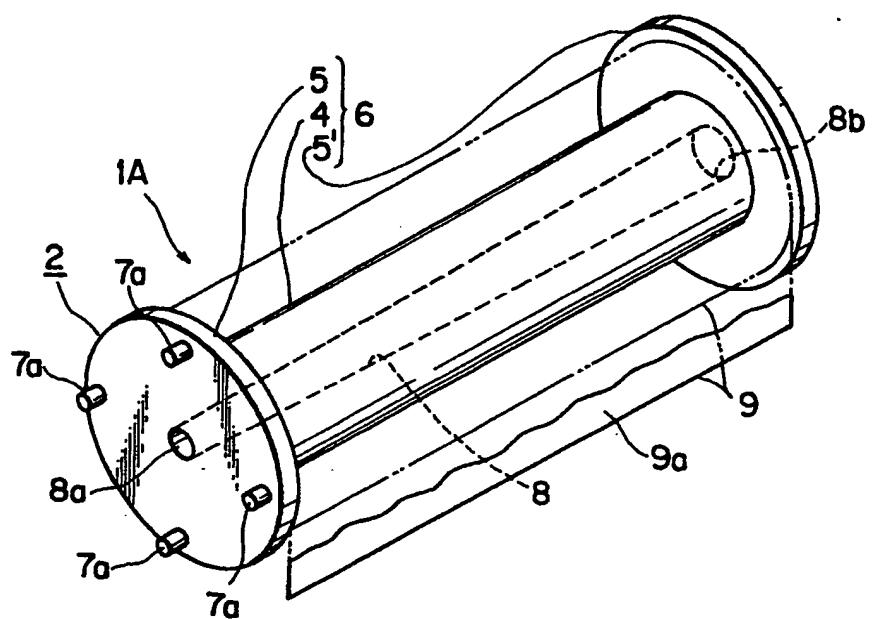


FIG. I (B)

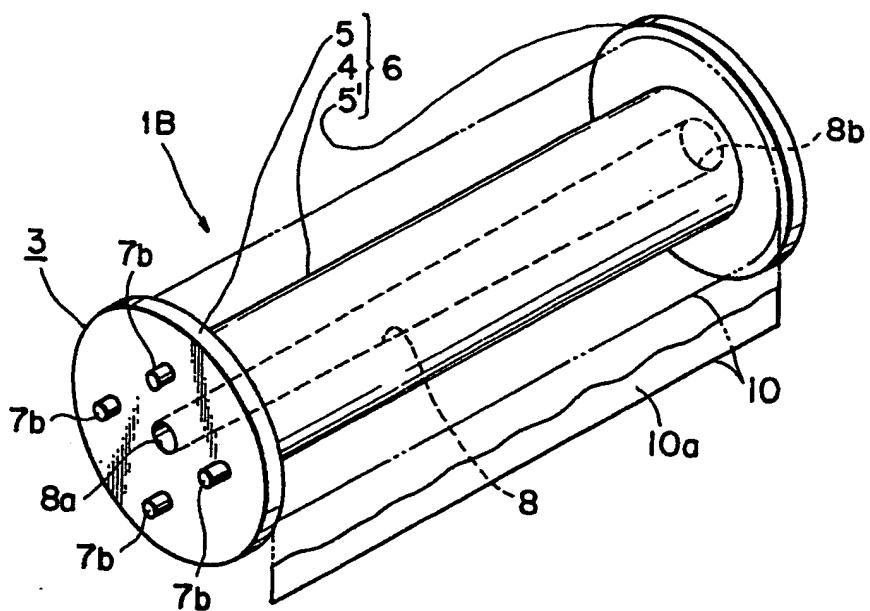


FIG. 2

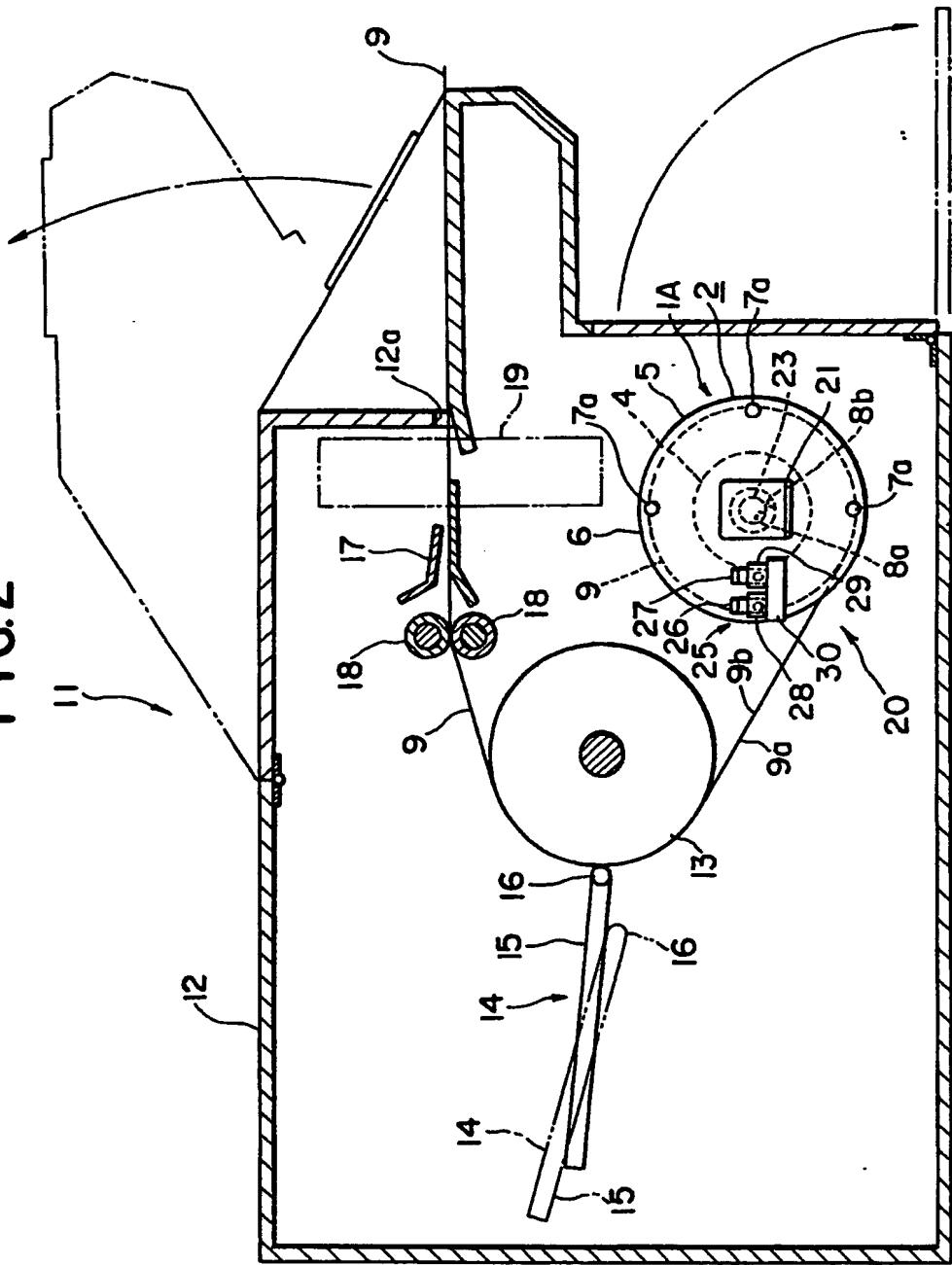


FIG. 3

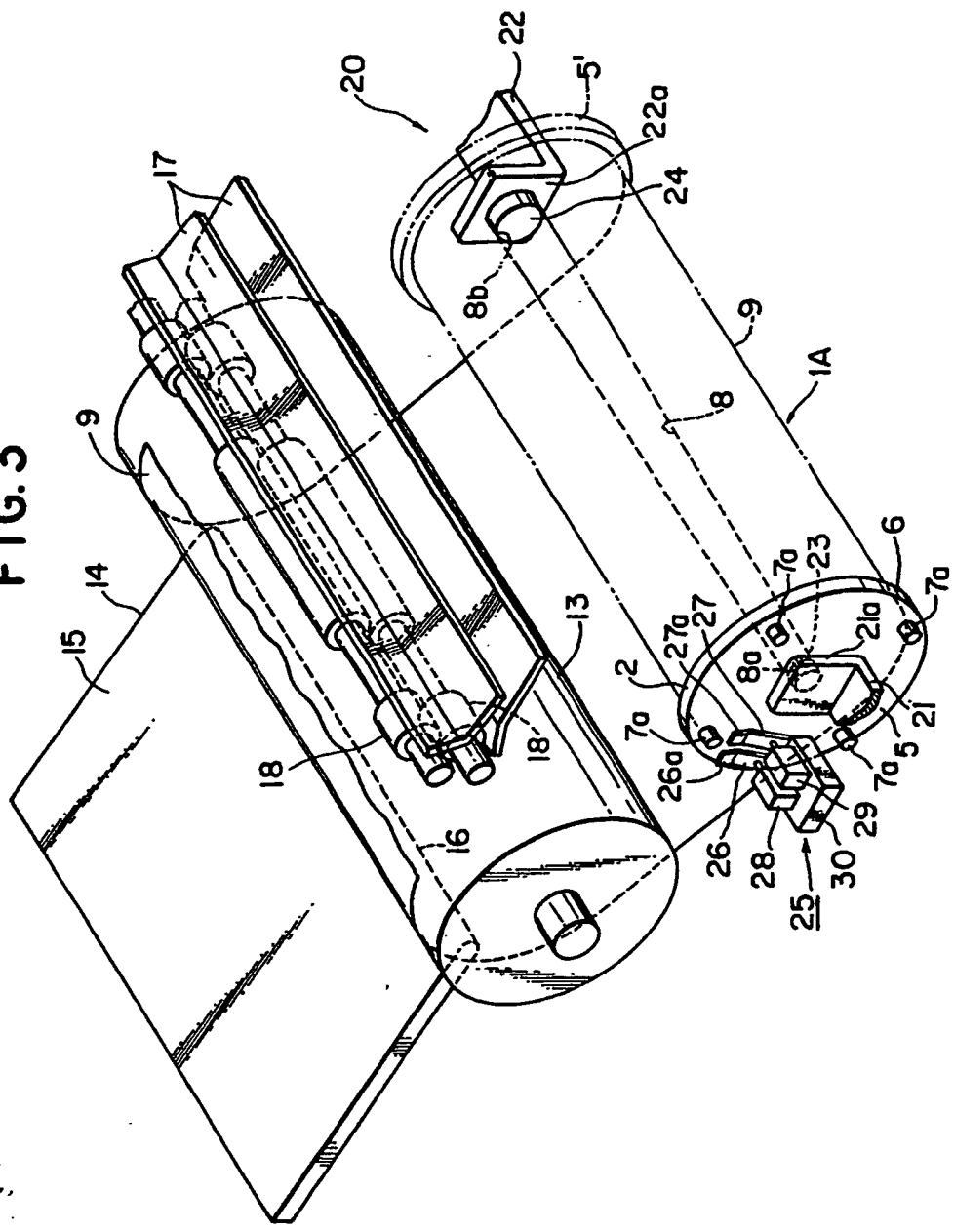


FIG. 4 (A)

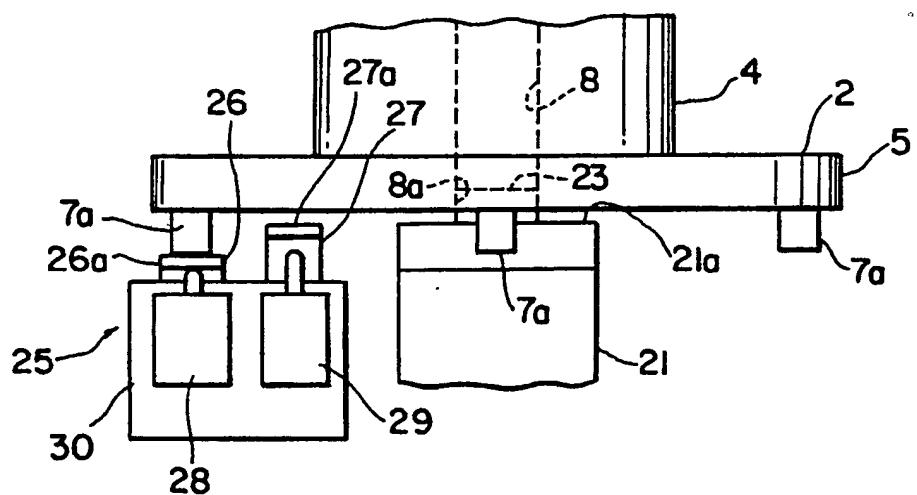


FIG. 4 (B)

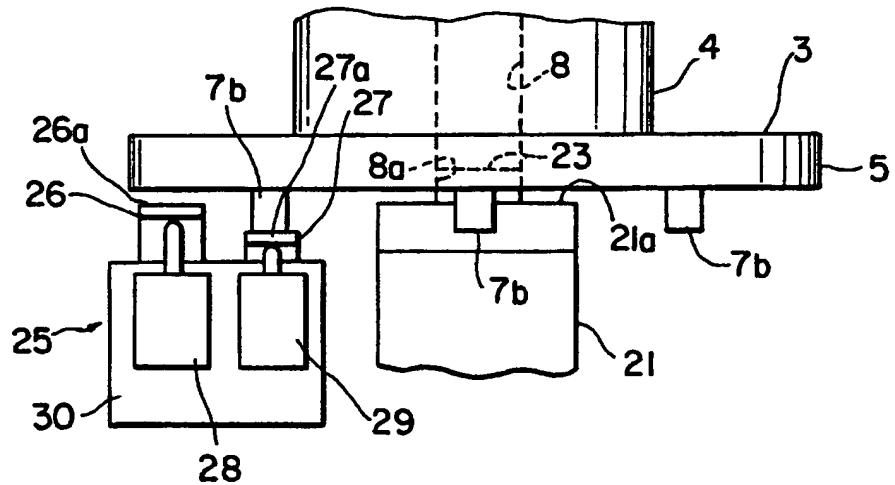


FIG.5(A)

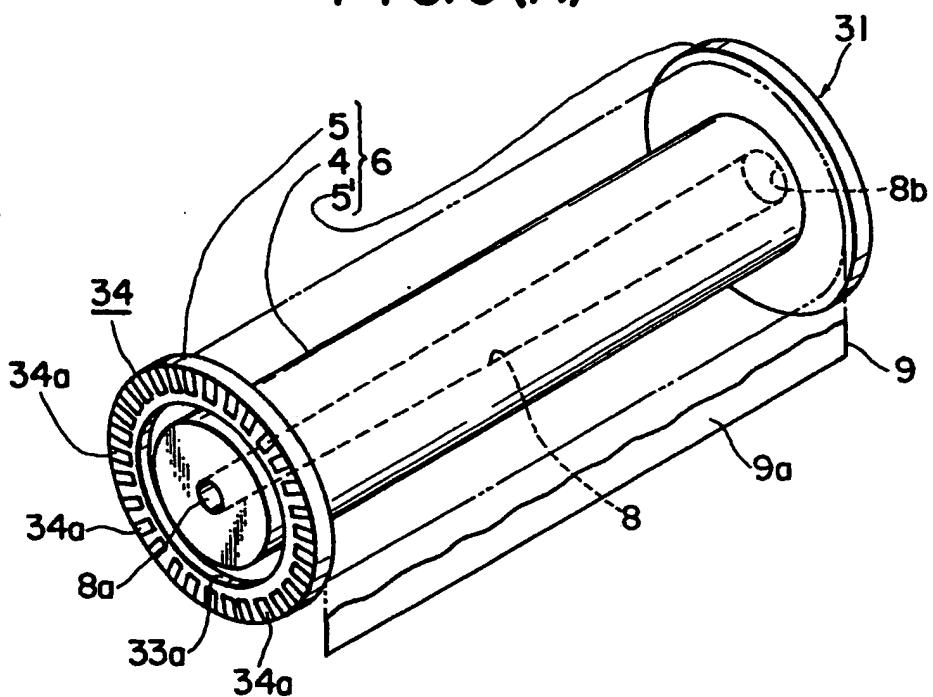


FIG.5(B)

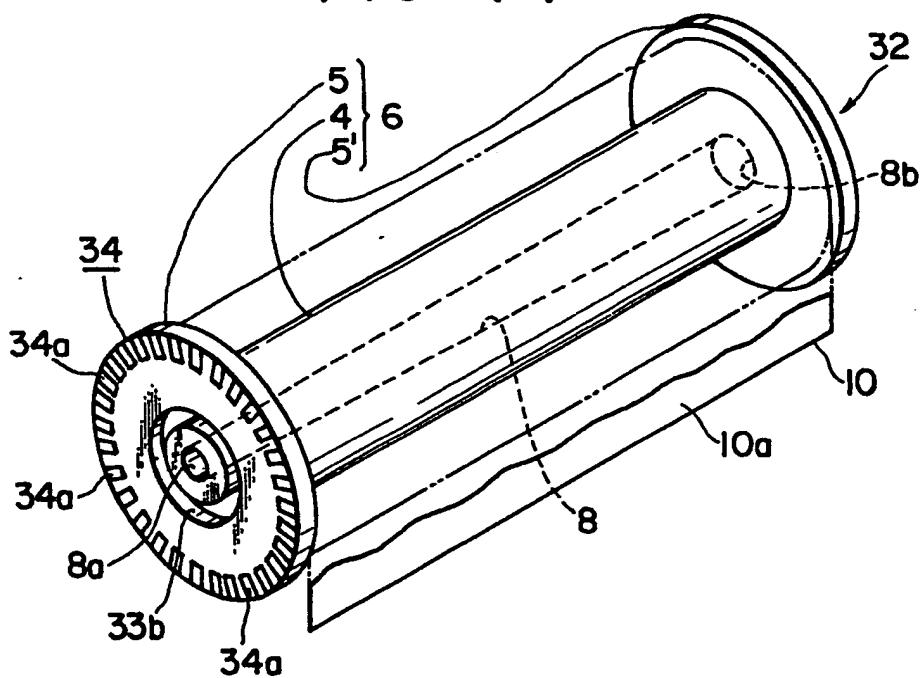


FIG.6(A)

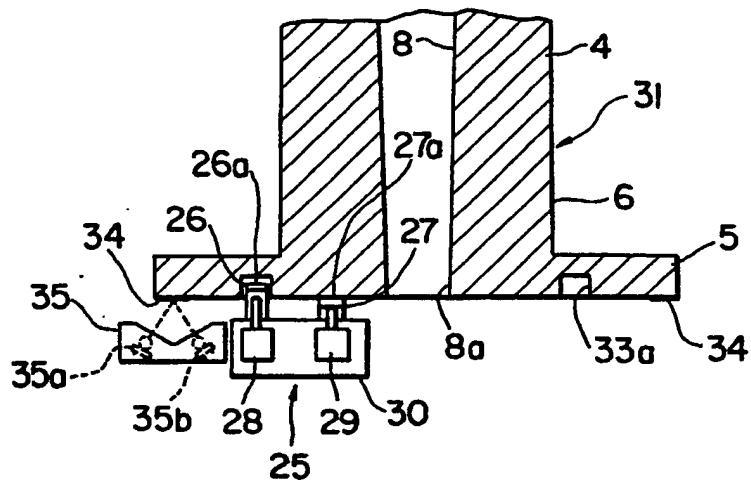


FIG.6(B)

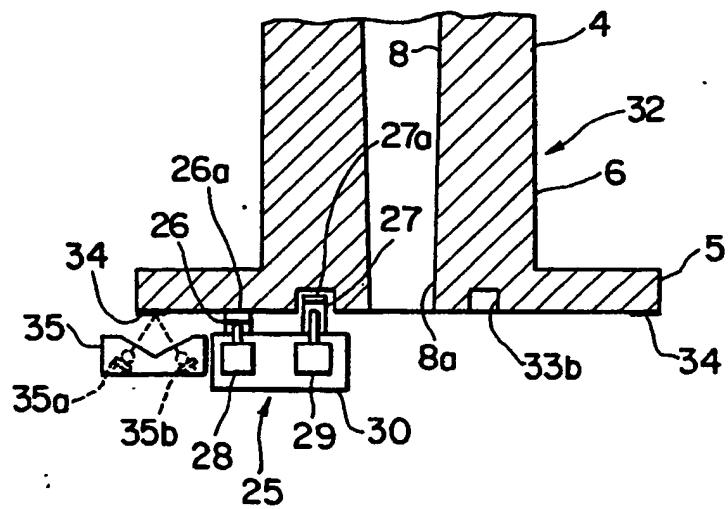


FIG.7(A)

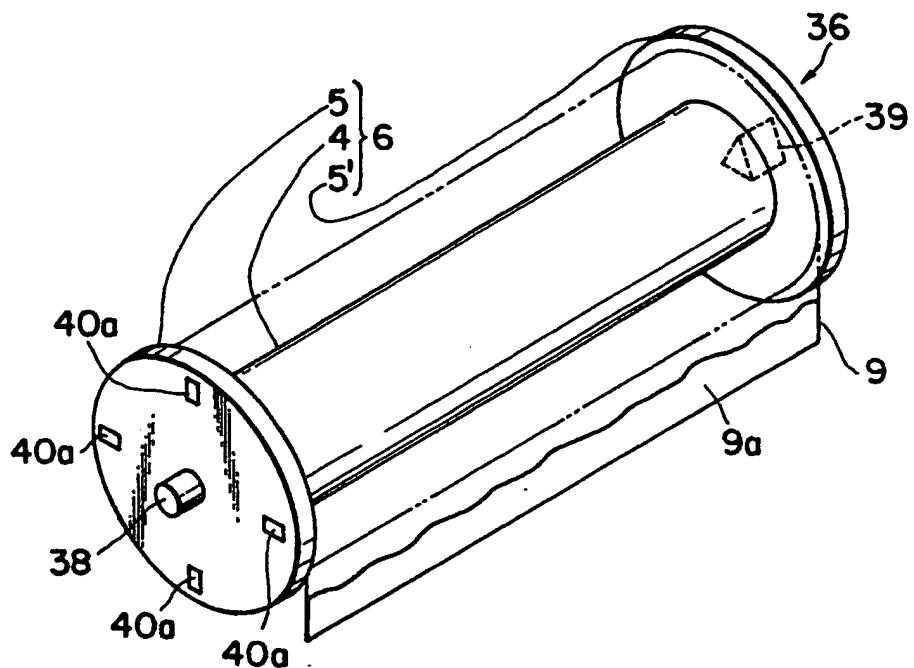


FIG.7(B)

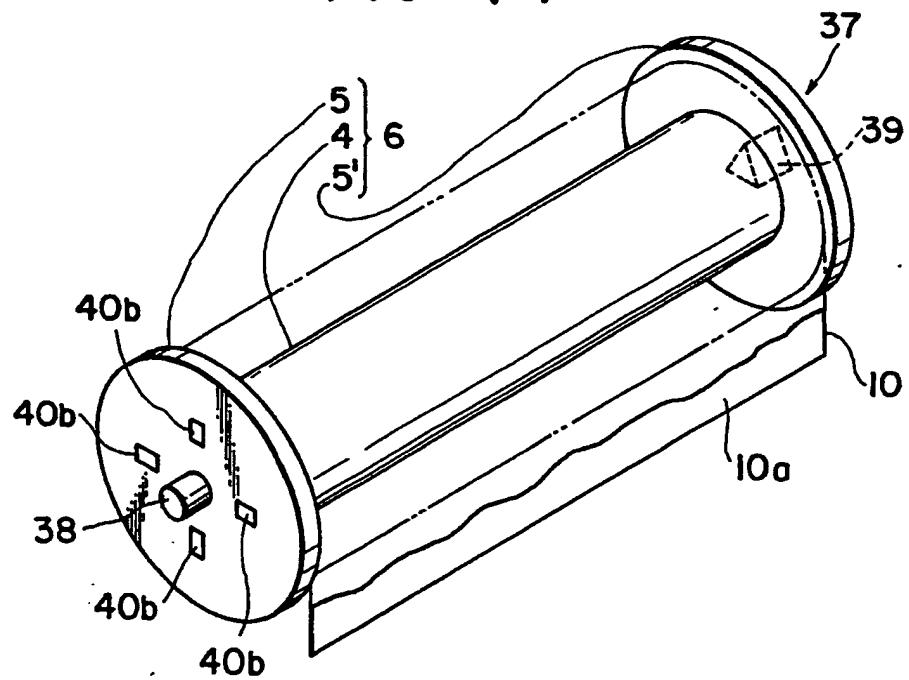


FIG. 8

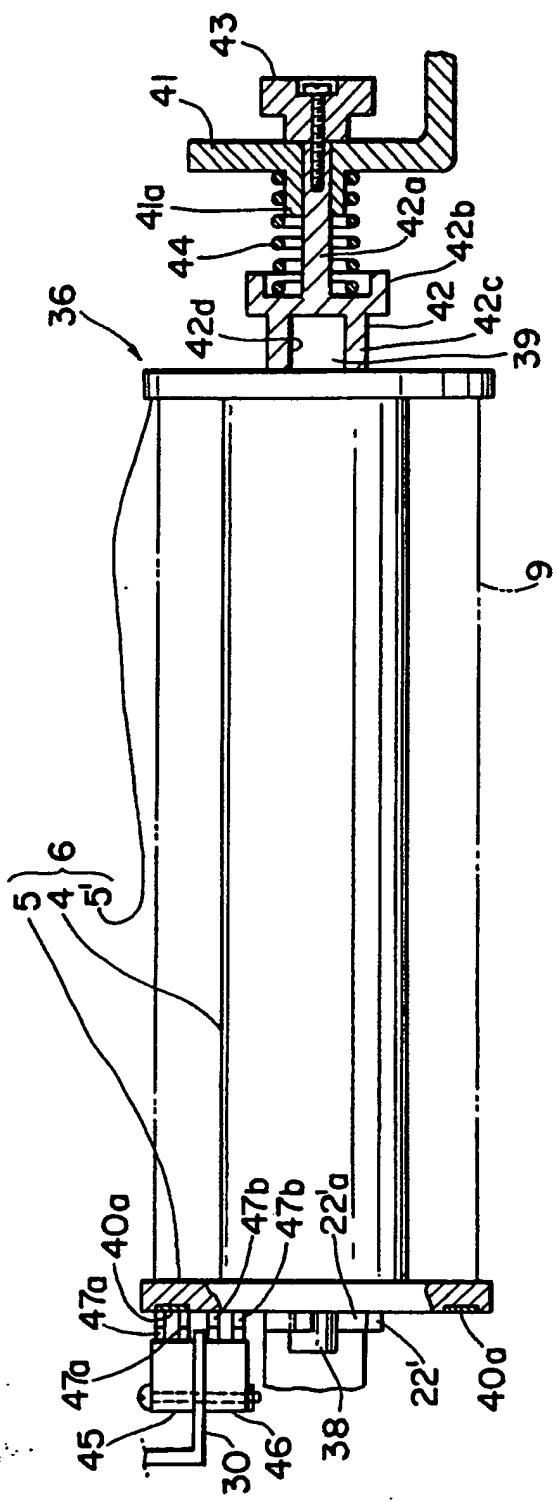


FIG. 9

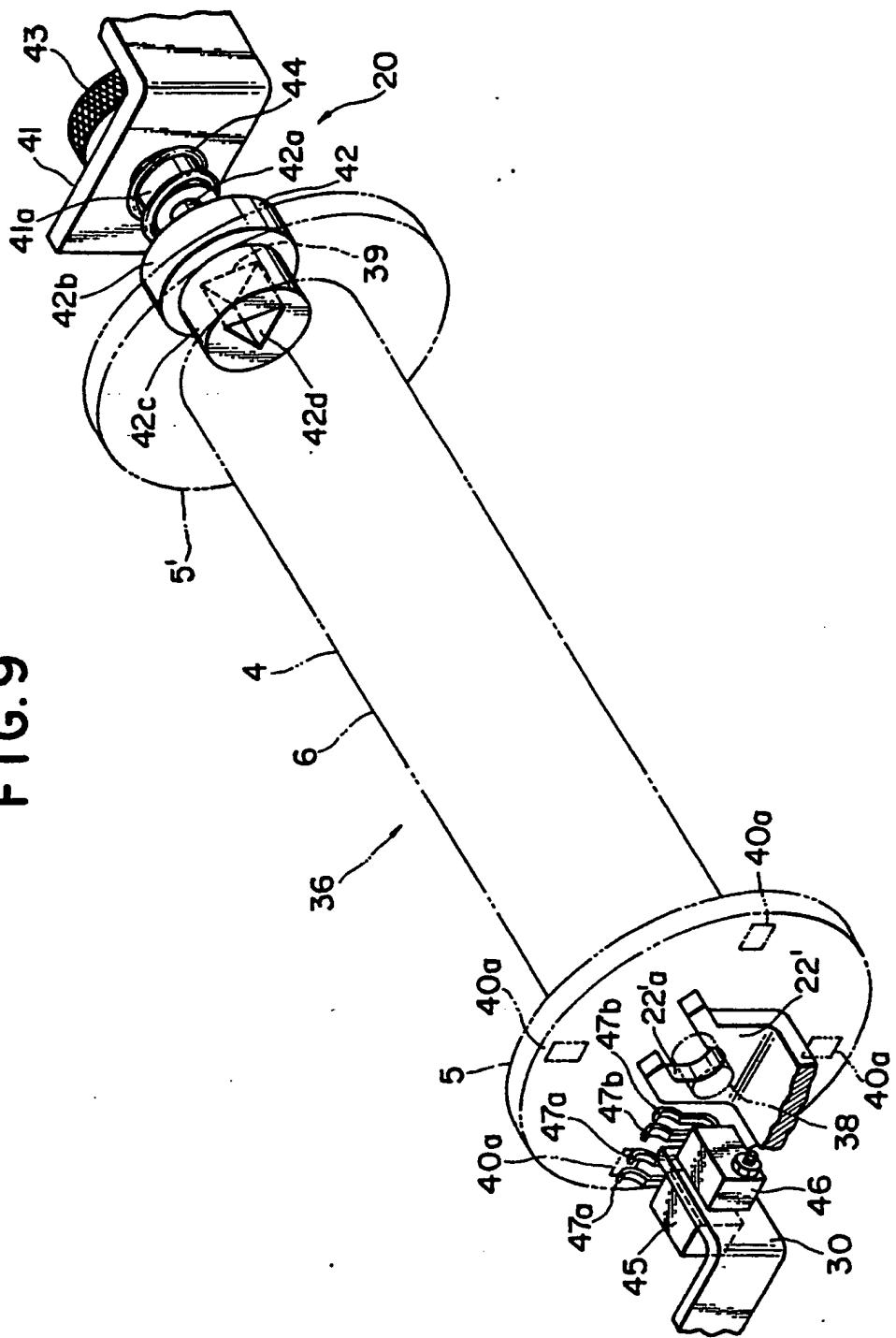


FIG.10(A)

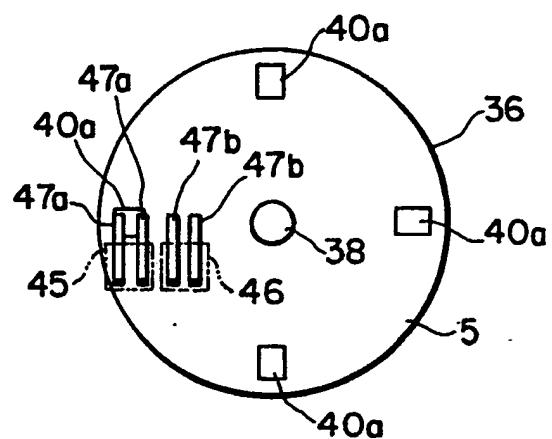


FIG.10 (B)

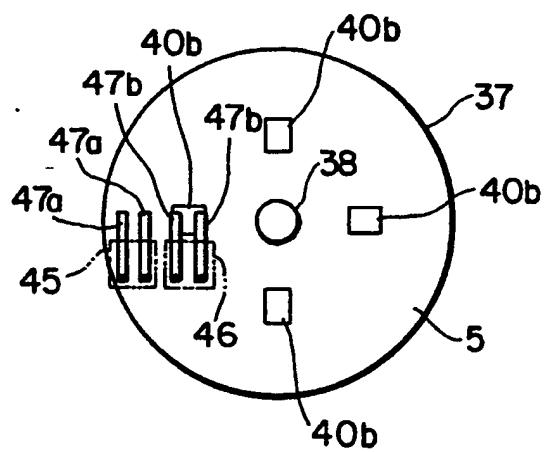


FIG.II(A)

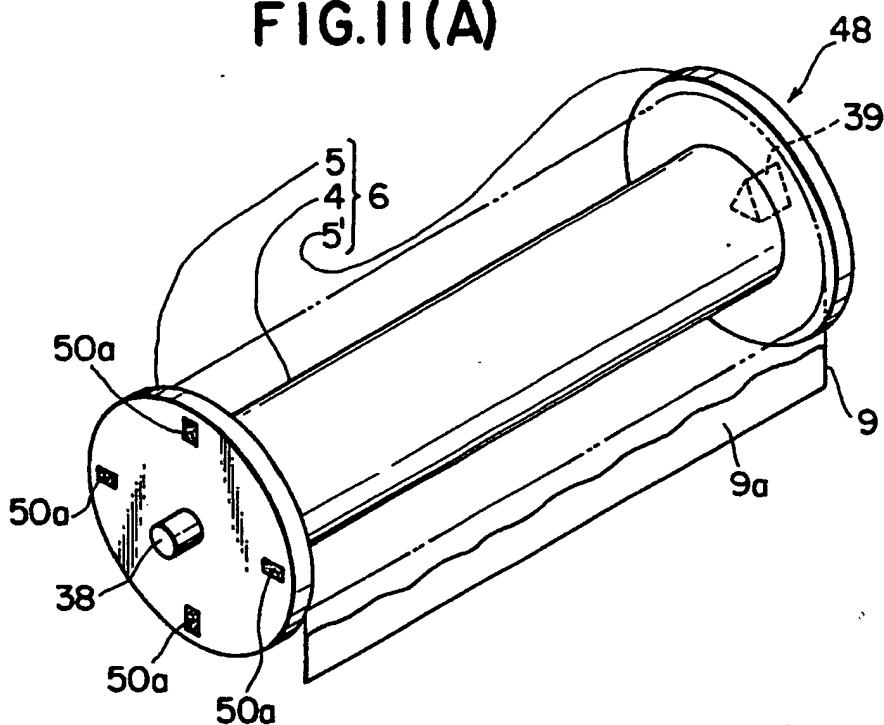


FIG.II(B)

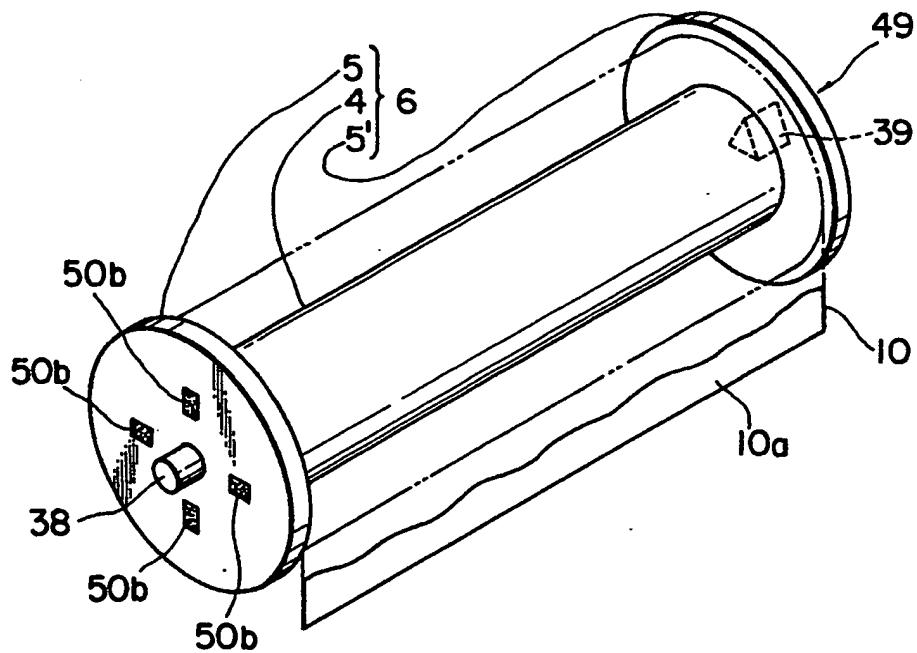


FIG.12(A)

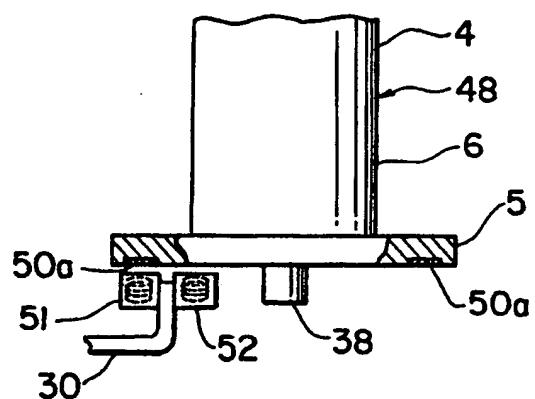
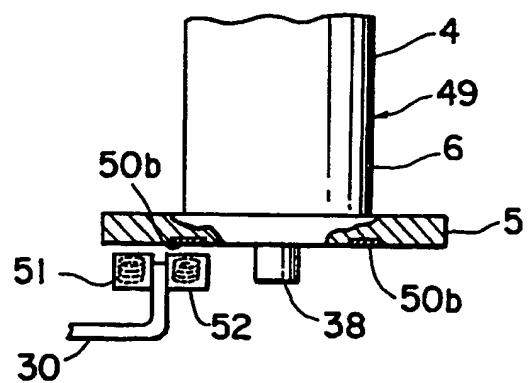
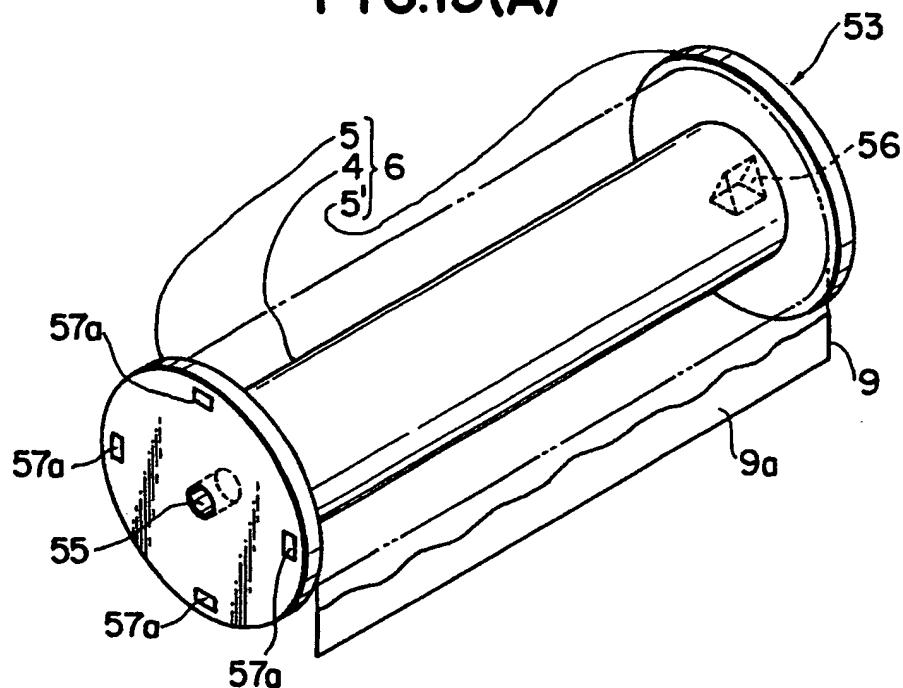


FIG.12(B)



**FIG.13(A)**



**FIG.13(B)**

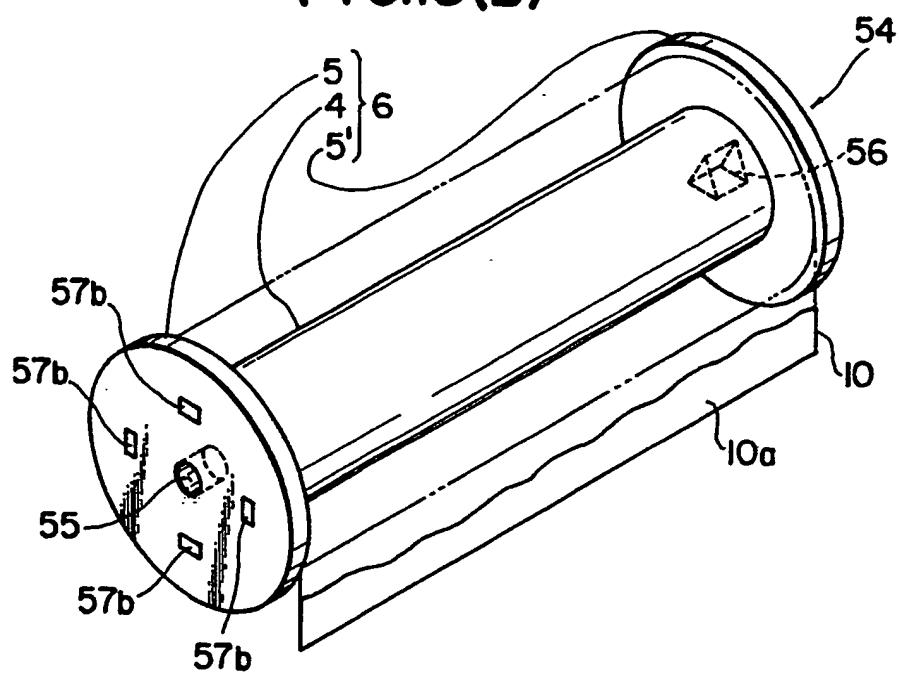


FIG. 14

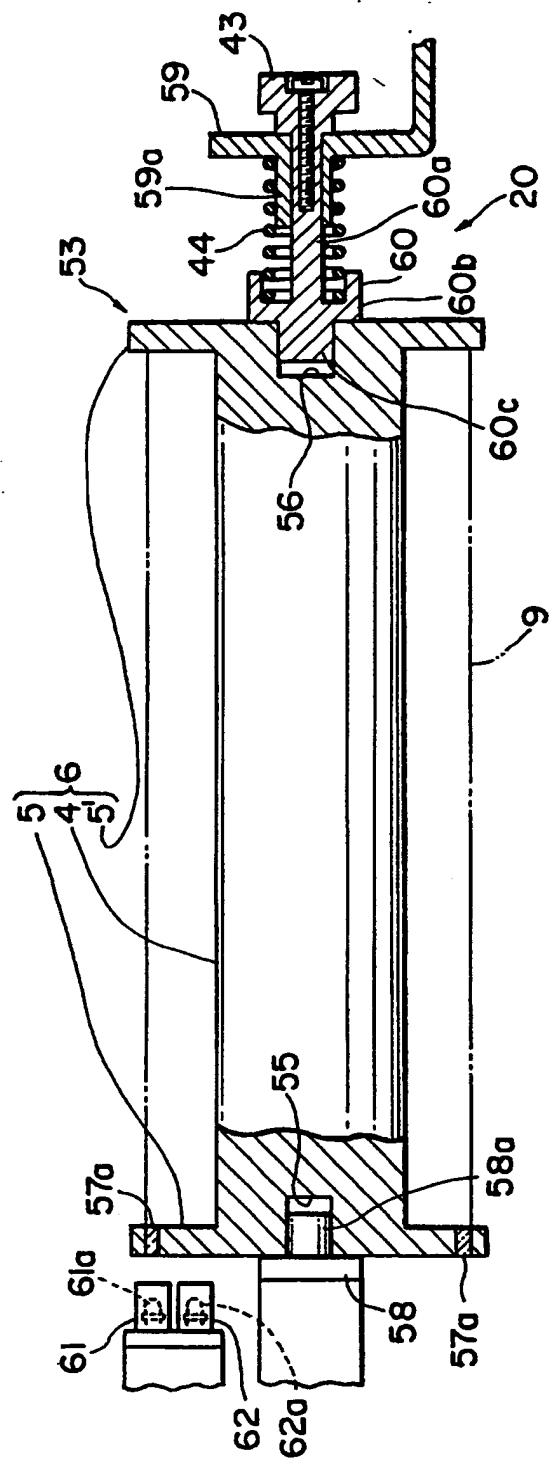
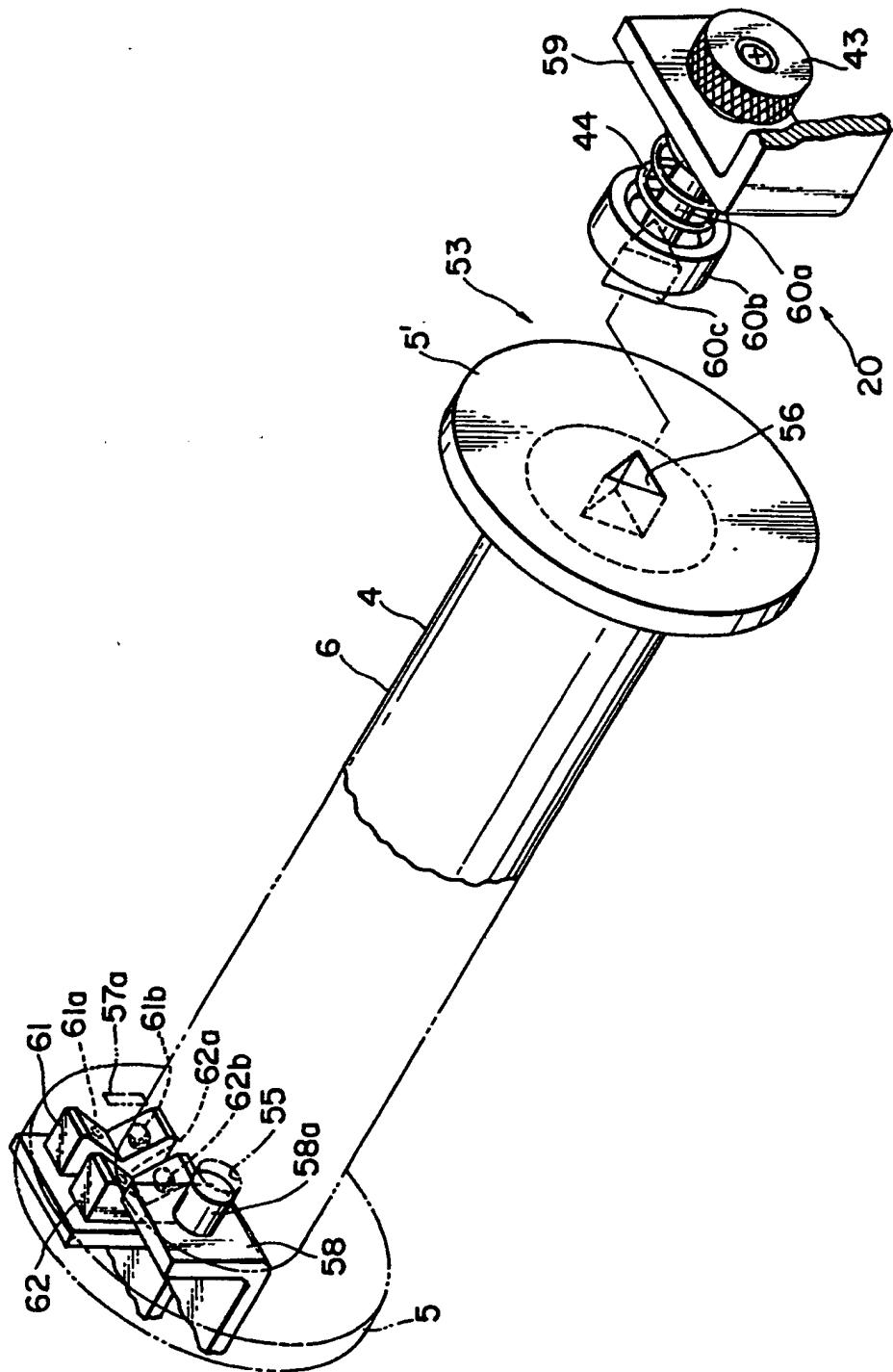
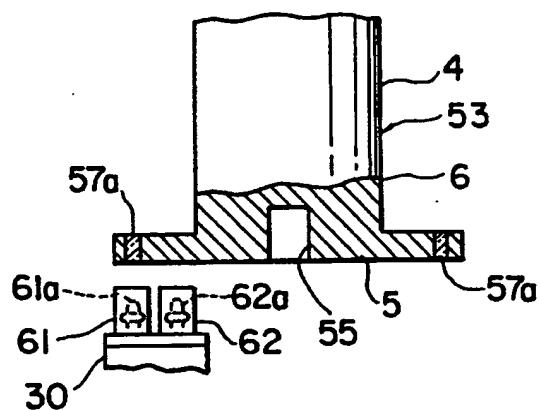


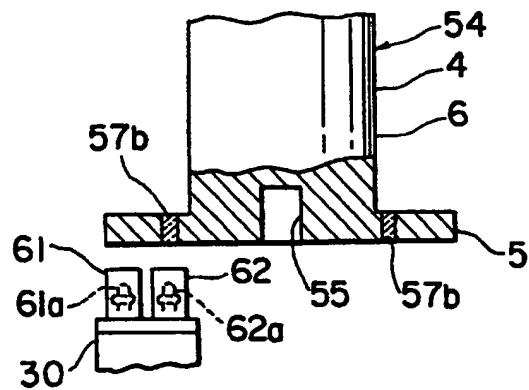
FIG. 15



**FIG.16(A)**



**FIG.16(B)**





European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number

EP 90 30 5997

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. CL.5)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	US-A-4 171 781 (R. KRAL et al.) * figure 2; column 1, lines 17-28; column 3, lines 48-52; column 4, lines 51-66 *	1	B 65 H 75/14 B 41 J 15/02
Y	---	2-4	
Y	PATENT ABSTRACTS OF JAPAN vol. 9, no. 231 (M-414)(1954), 18 September 1985; & JP-A-6087158 (FUJI XEROX) 16.05.1985 ---	2,4	
A	PATENT ABSTRACTS OF JAPAN vol. 7, no. 59 (M-199)(1204), 11 March 1983; & JP-A-57203577 (FUJI XEROX) 13.12.1982 ---	2	
Y	PATENT ABSTRACTS OF JAPAN vol. 11, no. 330 (M-636)(2777), 28 October 1987; & JP-A-62113570 (FUJITSU) 25.05.1987 ---	3	
A	DE-A-1 774 049 (W. FRIEDRICH GMBH) * page 1 - page 2, paragraph 3 * ---	1	TECHNICAL FIELDS SEARCHED (Int. CL.5)
A	US-A-4 699 034 (T. SUE) * Figures 2,8,9; column 3, line 22 - column 4, line 31; column 7, line 60 - column 8, line 4 *	1,3	B 41 J G 03 B G 03 G B 65 H
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
BERLIN	30-08-1990	FRITZ S C	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons  A : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			